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ANIMAL WEAPONS

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FALCON STRIKING
A PIGEON

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A N I M A L

W E A P O N S

BY GEORGE F. MASON



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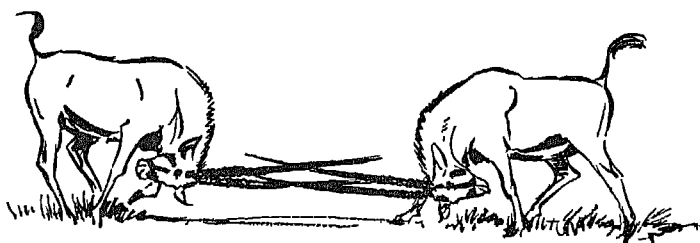
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ANIMAL WEAPONS

ACCORDING to nature's plan, all living things depend upon one another for their existence. Animals live by eating plants or other animals. Plants get their food partly from animal matter and partly from other plants. This scheme would not work out very well if it were not for a system of controls that serves as a balancing agent to assure the survival of each species.

The protection that weapons afford is a controlling factor in the lives of many plants and animals. Take, for example, the thorns on trees and bushes, cactus spines, and the barbs on rosebushes and blackberry briars. These sharp outgrowths are the weapons that prevent animals from eating the leaves and fruit of the plant. However, they do not keep the insects away.

Why does the porcupine have quills? These weapons are the porcupine's only defense, for he is so

slow and stupid that without them he would be an easy victim for any number of carnivorous animals. The fisher is one animal skillful enough to kill and eat a porcupine without suffering any ill effects. Fishers are apparently immune to the festering that results when porcupine quills are imbedded in the flesh.

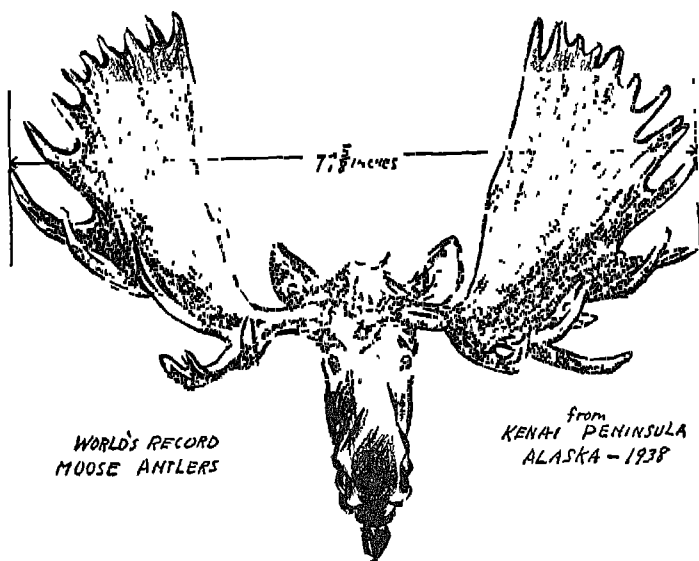
These examples of the part played by defensive weapons make it quite evident that nature did not intend to provide a complete protection for any plant or animal. There is always some form of life capable of overcoming any obstacles that weapons may offer; therefore they give only a partial protection, the purpose of which is to prevent certain plants and animals from being destroyed faster than they can be replaced. Such weapons act the part of a balancing agent in the machinery of life.

Weapons may also be used offensively or for procuring food. The sundew plant's tiny entangling hairs that catch and hold insects, the long sharp talons on an owl's feet, are necessary weapons that enable the plant and the owl to obtain food.

Animal weapons are also important for conquest as, for example, are the antlers on the male members of the deer family. Antlers are essential to the males when they fight for the possession of the females during the mating season.

Strictly speaking, a weapon is something used against an adversary for offense or defense. Traps or devices are not always weapons, but since they often have a similar purpose I have taken the liberty of including them.

Whatever purpose they may have, weapons are important in the struggle for existence. The following chapters discuss some of the interesting types of animal weapons and their influence on the lives of the animals who possess them.



HORNS AND ANTLERS

HOW THEY GROW

HORNS and ANTLERS are apparently grown to serve as weapons. It is possible that they may have a purpose other than that of fighting, for on some animals they are quite decorative. There is no doubt that they add to the physical attractiveness of the males, who usually grow the more perfect specimens.

Antlers are made of bone. They are usually branched and they are shed each year. They are grown by the male members of the deer family, with

the single exception of the caribou. Both the male and female caribou have antlers.

These antlers are used for fighting or defense during a very small part of the year. Antlers grow during many months and while they are growing they are too sensitive and fragile for combat. On the other hand, horns are permanent and are useful for fighting at all times.

The yearly growth of antlers is one of nature's most interesting details. When we see the enormous antlers on the heads of the moose or wapiti, it is difficult to believe that such huge masses of bone could be grown in the comparatively short period of five months. When they are full grown, they are useful as weapons for a similar length of time. Then they are discarded. What is the reason behind this apparent waste of the animal's energy and vitality? Why didn't nature let these animals keep their antlers, just as the horned animals keep their horns? There is a reason, no doubt, but man does not have the answer.

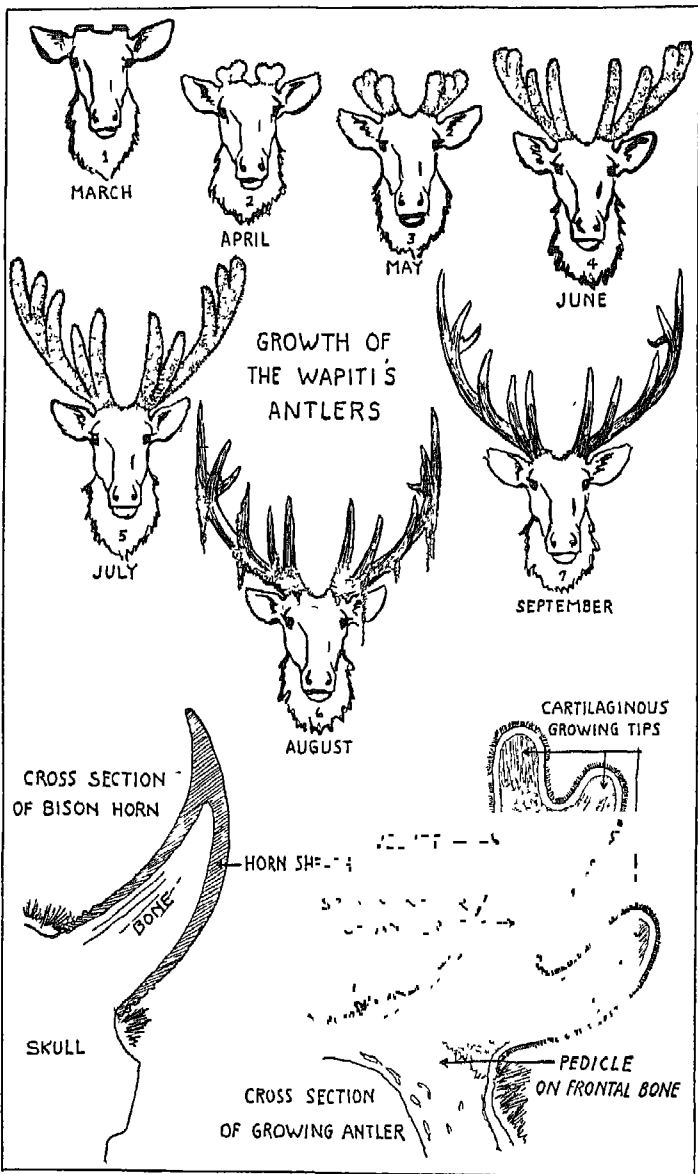
Antlers are shed in late winter or early spring, leaving two bloody scars on the animal's head where the antlers were attached to the pedicles. Pedicles are cylindrical outgrowths on the frontal bone of the skull from which the new antlers begin their growth. A few weeks after the antlers are dropped, an in-

crease in the blood flow to the pedicle areas causes a rapid change in the skin around the scars. A new growth of skin forms, completely covering the surface of the scars. This new skin is soon covered with a soft hairlike surface resembling the texture of velvet, which is probably why mammalogists always call this skin "the velvet."

While the velvet is covering the scar areas, a cartilaginous growth forms on the pedicles beneath. This is the beginning of the new antlers. As the cartilage grows out into the shape of the antler, it gradually hardens into bone. The outside wall is the first to harden, while the inside remains a mass of soft bone tissue through which the growing antler receives its nourishment.

During most of the five or six months which it takes for the antlers to reach maturity, they are completely encased in the velvet. This is so sensitive that the animal avoids striking the growing antlers with any force, for it would not only be painful but might cause a permanent injury or deformity to the antlers.

When the antlers reach their full growth, the velvet loses its vitality and becomes dead tissue. This soon falls off or is rubbed off by the animal as he strikes his antlers against the brush. They are now completely hardened into bone and are so strong that the animal can charge full force into any ob-



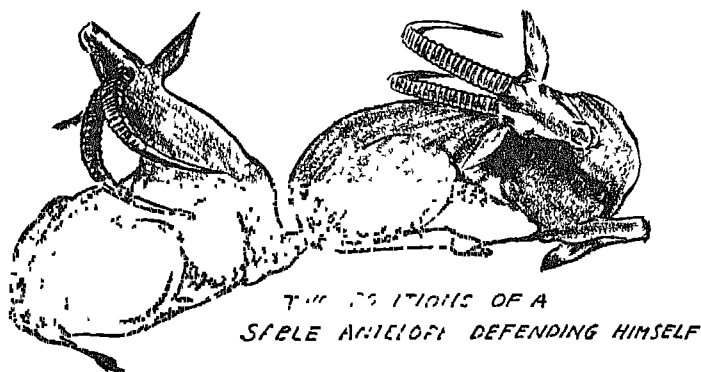
struction without causing any noticeable injury to the new weapons.

The shape of antlers, and no two are ever exactly alike, is predetermined. Heredity influences their development, while diet may affect the size. If the antlers on an animal have a peculiar shape other than that caused by injury, it is quite probable that the same peculiarity will reproduce itself on the new antlers every year.

Horns differ from antlers in that they are hollow, unbranched, and, except in the case of the pronghorn antelope, permanent. This antelope is the only horned animal that sheds its horns yearly.

Horns are made of material similar to that of hair, claws, hoofs, and nails. In many instances both males and females have horns. Their growth differs in many respects from that of antlers. The hollow-horned animals begin to show small lumps or buttons on the frontal bone when they are only a few months old. These buttons are the beginning of two bony structures that emerge from the skull to become the cores over which the horny sheaths grow. The sheath, or horn, develops from the horn-secreting cells in the skin surrounding the base of the core. These cells are very active during the first few years of an animal's life and continue to deposit small additions to the horn structure as long as the animal lives.

The type of horn grown by the rhinoceros has a different story. That long sharp horn on his nose is a terrible weapon, which strangely enough has no core and is made of hair cemented together in one solid mass. The source of this hair growth is in the animal's skin and not in the bony base on which the horn rests, as we might suspect from its appearance.



HORNS AND ANTLERS

HOW THEY ARE USED

IF you could be in any one of the areas inhabited by moose, deer, elk, or caribou during the late summer, you would see many places where the bulls have polished their antlers on the branches of bushes and small trees. They do this at first to clear off the remains of the velvet, but later in the season it is more of a challenging action, or an expression of the animal's fighting spirit. The noise made by the antlers crashing against the branches can be heard for quite a long distance and hunters sometimes imitate the sound by striking tree branches with a gun barrel or a stick. The unwary bull hears this noise and goes to meet the challenger, only to step into the range of the hunter's gun.

A man from Texas told me that in his state he could attract deer during the mating season by sitting in a tree and knocking two shed antlers together in imitation of a fight. According to his story, it was not uncommon to attract several deer within a few feet of the tree in which he sat. Deer seldom look up into a tree because their attention is always focused on objects near the ground.

During battles between antler-bearing bulls, there is always the danger that the antlers will get hopelessly locked together. When this happens, it means a horrible death for both animals, either from starvation or attack by wolves. Sometimes the animals are located before they die and a game warden is summoned to separate them by sawing off one or two spikes. This is a dangerous job to perform, but there are records proving that it has been done successfully.

For fighting purposes, the size of antlers and horns is not as important as the shape. This fact was brought to my attention in Alaska where I witnessed several fights between bull moose. If the animals were almost equal in weight and strength, the position and length of the brow tines was a deciding factor in winning the battle. The moose that bore the largest antlers ever recorded was killed by another bull whose antlers were undoubtedly smaller,

but they were equipped with long well-placed brow tines that punctured his opponent's skull when their lowered heads clashed together. Fortunately, the body of this dead moose was discovered by a hunter and the head with the huge antlers intact was brought out of the wilderness where members of a museum expedition secured the trophy for their museum. This pair of antlers had a spread of seventy-eight and five eighths inches when first measured. Although this moose had the distinction of having the largest antlers of any so far recorded, he had poorly shaped weapons for fighting. The brow tines were short and badly formed, and the palms lay so flat that the tines were of no use as weapons, although to some extent the palms may have acted as a protecting shield.

The wide flattened palms are very useful in protecting the moose when he is on the defensive. In one memorable battle, I saw a bull go down from the impact of his opponent's charge. The standing moose quickly backed away and again rushed at the prostrate bull's exposed flank, but the fallen moose swung his head around and received the full force of the deadly thrust on the palms of his antlers and no visible harm was done. Later, he staggered to his feet and continued the fight on more even terms.

After the fighting season is over, the antlers are

among the caribou bulls. Their antlers have delicate spikes that break off quite easily.

The American wapiti has the most beautiful example of the branched type of antlers. The male is quite docile while his antlers are in the velvet, but as soon as they are fully developed his temperament changes and he gets mean and dangerous. As a rule every wild male wapiti must fight for his mate. Competition is keen, and the strong fighters are the ones who succeed in winning and holding the greatest number of cows during the mating season.

Young bulls often joust with one another in mock fights. These playful contests give the youngsters valuable experience in the use of their weapons, preparing them for the real battles they may have in later years.

While watching an old bull wapiti pawing a bed out of the steep slope on a mountainside in the Olympic range, I was surprised to see that he used his antlers to loosen the earth. This old fellow had found a use for his antlers other than for fighting.

The heavy, thick, curled horns of rams are useful only as battering devices, and the animal depends on the shock of the blow to defeat an enemy or rival. How different is the fighting method of a mountain goat who has comparatively small, thin, daggerlike



MOOSE



CARIBOU



VIRGINIA
DEER

ANTLERS



ROCKY MT. GOAT

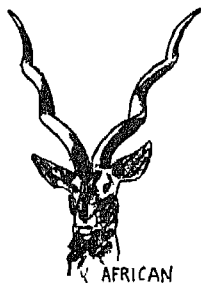


STONE SHEEP

HORNS



PRONGHORN
ANTELOPE



AFRICAN
KODDOO



ELAND



INDIAN
WATER BUFFALO

horns. The goat is well armed and he knows it. He can defend himself against any animal his size, and even a man who ventures near a wounded goat is taking a chance of being badly wounded himself.

It is amazing how animals adapt their fighting methods to the style of horns they possess. Some horns look like excellent weapons, but there are many oddly shaped horns that give the appearance of being quite useless for fighting.

At first glance, the horns of the pronghorn antelope look like very poor weapons. The tips turn inward to such a degree that they appear to be of no use in combat, and the prong is too short to cause much damage to an opponent. Yet the buck antelope is a vicious fighter and his weapons are capable of inflicting severe wounds that are often fatal. This shows that his horns are admirably suited to his style of fighting. The prong serves as a guard to prevent an adversary's horn from slipping down to the vulnerable parts of the head and neck. The intuned horn tip acts like a hook when the antelope succeeds in getting it to bear on an opponent's throat, where a sideways thrust would bring the sharp tip across the neck with deadly effect.

The same mistake in judgment might result if we appraised the fighting value of the long curving horns of the African sable antelope solely on their

appearance. Such horns are often so curved that they form a half circle with the point directed downward to within a few inches of the animal's back. These horns look as though they might even endanger the life of the animal who owns them. They certainly seem to be of no value as an offensive weapon. Actually, the sable antelope's horns are excellent fighting weapons. He uses them in the only way possible for a weapon of such shape—like a swinging scythe or sickle. When a sable antelope is at bay, he lies down in a kneeling position and stretches his neck out with the head turned sideways and skillfully swings his head from side to side, giving a sweeping scythelike motion to the horns. The sharp points pass over and across his back with lightning speed and impale the attacking animal.

The fencing bouts between gemsbok or oryx antelope are very spectacular. These animals have long, almost straight, slender horns that may be four or five feet in length. When dueling with one another, the animals bow their heads until the nose is pointed back between the front legs, which brings the long points forward in the direction of the opponent. In this awkward position, the animals thrust and parry as skillfully as fencing masters.

The giraffe has rather short horns that are covered with hair. They are practically useless as weapons,

but giraffes can fight among themselves with deadly consequences. The giraffe attempts to break the neck of his opponent by sweeping swings of his own head and neck. If he succeeds in striking the long neck of his opponent, the blow is quite apt to be fatal. A giraffe defends himself against such an attack by backing up close to the front of the aggressor. Then when the giraffe swings his head, the defensive animal merely lowers his head and ducks the blow.

The long, low, curving horns of the Indian water buffalo are very helpful in fighting off the attack of a tiger. The horns are in such a position that any motion of the head brings the points around close to the neck, where the tiger usually attempts to secure a hold.

The beautiful African koodoo has long spiral-shaped horns that are useful both for fighting and for securing food. It is not uncommon for the koodoo to hook his spiral horns over a tree branch and break it down to gain access to the leaves. The giant eland and several other antelope have the same habit of using their horns for feeding purposes.



HOOFS, NAILS, CLAWS, AND TALONS

HOOFS, NAILS, CLAWS, and TALONS are outgrowths from the feet or wings of animals, and they often serve very effectively as weapons. Such birds of prey as owls, hawks, falcons, and eagles all have long, needle-sharp talons, the chief purpose of which is to clutch and kill. The beaks of these birds look very dangerous, but the hooked beak is used to tear the flesh of a victim into pieces small enough to eat, while the talons are the weapons that do the killing.

Falcons are very skillful at killing their prey by striking with their armed feet while in full flight. The handsome duck hawk is bold enough to venture into the very heart of the city on his murderous quest for

ANATOMY OF A CAT'S CLAW



EXTENDED CLAW



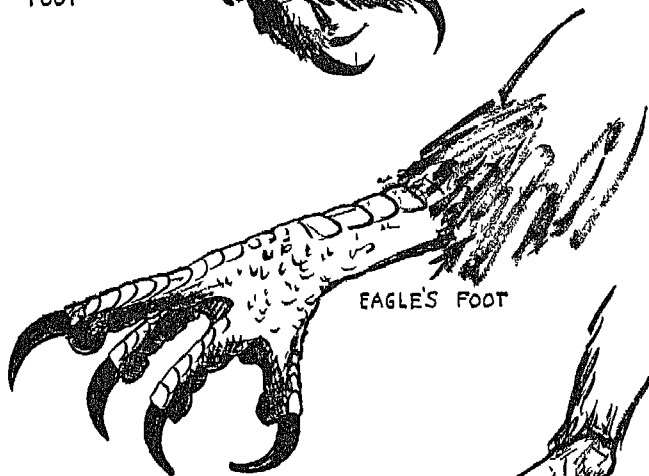
RETRACTED CLAW



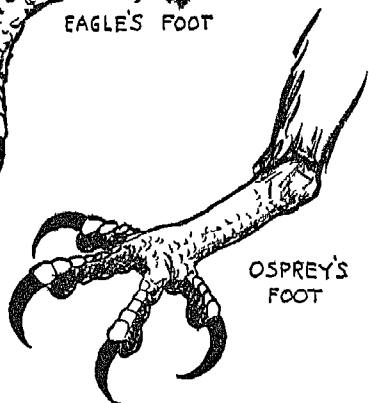
TIGER'S PAW



OWL'S
FOOT



EAGLE'S FOOT



OSPREY'S
FOOT

domestic pigeons. I can always tell when this falcon is paying a call on the birds around the Natural History Museum in New York City, when I observe the frantic flight of the sparrows and pigeons and hear the chattering war cry of the falcon as he circles and dives about the towers and rooftops. He does not attempt to capture a sitting bird, for he prefers to strike the victim while flying high in the air where his great speed makes such a feat possible. I believe that the falcon screams to frighten the birds out of their hiding places in the niches and on the window shelves of the buildings

The feet of the larger owls and eagles have an exceptionally strong gripping power which forces their daggerlike talons deep into the bodies of their victims. An eagle's feet are so powerful that a strong man is unable to force a single toe from its viselike grip. The king of all birds defends himself when on the ground by lying on his back and thrusting out his two armed feet in a menacing manner.

I once found the skeletons of an eagle and a fox which told a tragic story of death in the wilderness of Alaska. The fox had evidently succeeded in killing the eagle, but he had failed to reckon with the danger of the eagle's feet which had gained a grip on his throat and remained locked even after the bird had died. The fox suffered a terrible death with the dead

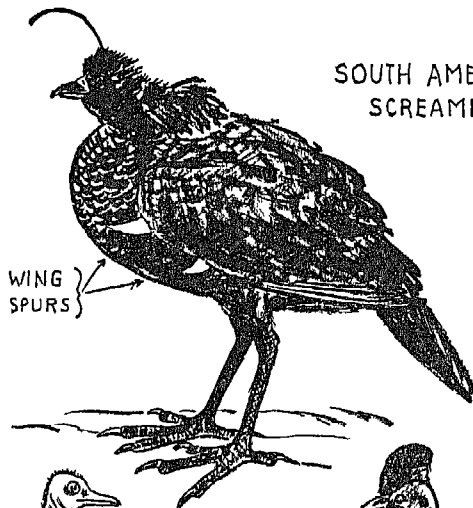
eagle's feet holding him in a grip from which there was no escape.

The osprey uses his feet to capture fish. He swoops down out of the sky and plunges his legs deep into the water where his extra long, sharp talons sink into the unwary fish who struggles in vain as the bird's powerful wings beat the air, lifting him out of the water. The osprey always holds his fish so that it lines up with his direction of flight, thus taking advantage of less air resistance against the fish.

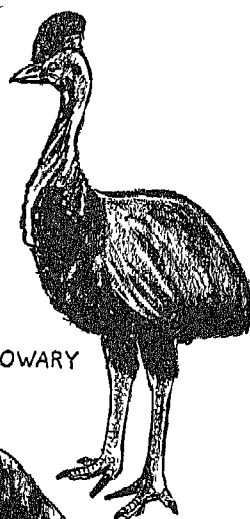
The feet of big birds like the ostrich, emu, and cassowary are armed with strong thick nails that make dangerous weapons when these birds kick. The ostrich and cassowary kick forward and downward, but the emu kicks sideways and backward. The foot structure of these birds is quite different. The ostrich is unique in having only two toes on each foot. The cassowary has an exceptionally long nail on the inner one of his three toes, and the emu has three toes with nails of nearly equal size. Any one of these birds can kick with sufficient force to injure a person severely.

Swans, geese, barnyard roosters, and screamers use their wings as weapons. I can remember a beating I received from one of my grandfather's geese when I was a small boy. The goose seized me by the seat of the pants and gave me a painful drubbing with his powerful wings. The front edge of the wing

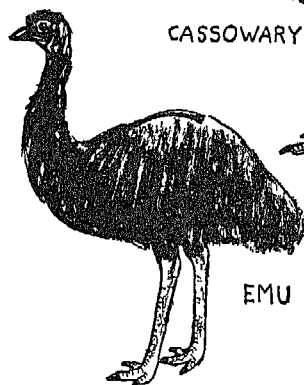
SOUTH AMERICAN
SCREAMER



OSTRICH



CASSOWARY



EMU

near the pinion bone is the part that hurts in striking.

Roosters use both wings and spurs when they attack. In some countries roosters are bred for their fighting qualities. These courageous birds are skillful fighters, and in a contest defeat often means death. Several species of birds and barnyard fowl have spurs on their feet.

The South American screamer is about the size of a swan. This strange bird has two vicious-looking horns growing from the forepart of each wing. It is fortunate for us that our domestic geese and roosters have not developed such weapons as these dangerous wing spurs.

Kangaroos are notorious for their ability to kick. Their feet are tipped with strong nails, making them as dangerous as blunt spears. When a kangaroo defends himself, he sits back on his tail which supports him as he strikes an adversary with his hind legs.

The timid little cottontail rabbit is an extreme contrast to all these powerful kicking animals, but if you ever capture a wild rabbit alive, the chances are that you will get badly scratched by his kicking hind legs. The fur on a rabbit's toes conceals long sharp nails. When rabbits fight with one another, each attempts to leap on top of the other and kick downward.

Horses, mules, zebras, and burros use their hoofs for weapons and are able to kick with both front and

back feet. The kick of any one of these animals is extremely dangerous.

I know of an instance where a mare saved her little colt from being killed by a grizzly bear. With well-directed kicks this courageous horse drove the bear away, but a raking claw mark on her flank showed that the fight had been a desperate affair. There must be one bear in the Cassier Mountains of British Columbia who has learned that there is no fury equal to that of a mother defending her young.

The grizzly bear uses his huge front paws for weapons and I believe they are far more deadly than his teeth. Each paw has five long claws that are very useful for digging out ground squirrels and for pinning down the slippery salmon in the stream beds, but the bear's enormous muscular front legs are capable of dashing the brains out of man or beast with the sheer strength of the blow. The claws are not so important as weapons although they can rip and tear.

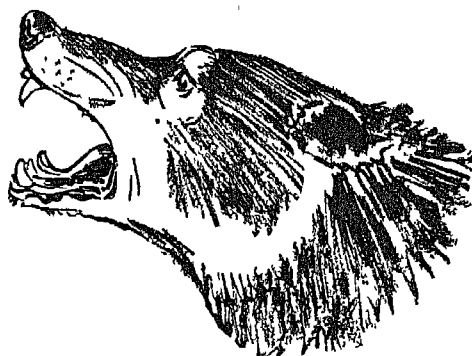
After talking with a few men who have been attacked by bears, I have come to the conclusion that if there is no escape, a man has a better chance of surviving a bear's attack if he lies down and plays dead. He may get badly bitten, but the bear is less likely to strike a prostrate man, while he is almost certain to hit a standing or running one. Fortunately, most

grizzly bears try to keep away from human beings, but now and then a man meets a bear who has a nasty disposition and no fear of the sight or scent of man. This bear is quite likely to run in the wrong direction.

The members of the cat family are provided with sharp retractile claws that are very useful for fighting and capturing other animals. The lynx, ocelot, jaguar, leopard, mountain lion, tiger, and African lion have claws of this type. Anyone who has witnessed a fight between two tomcats can understand the importance of claws as weapons. The cat's claws are shaped in such a way that, once they are imbedded in the flesh, the victim's struggling only serves to draw them in to a greater depth.

The sharp-edged front hoofs of moose and deer are often used as weapons, particularly after the antlers are dropped in the winter. The moose seems to be more aggressive at this time than when he is armed with antlers. Trappers in Alaska have told me that they are frequently treed by moose when following their trap lines in late winter.

Deer often strike with their front hoofs in a playful manner, but they can inflict considerable damage with their feet if they wish to do so.

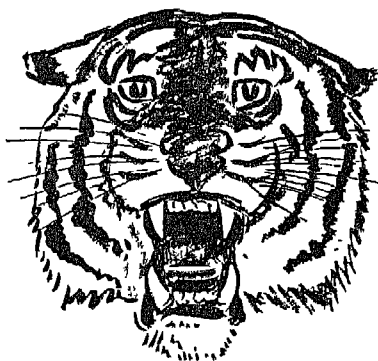


TEETH AND TUSKS

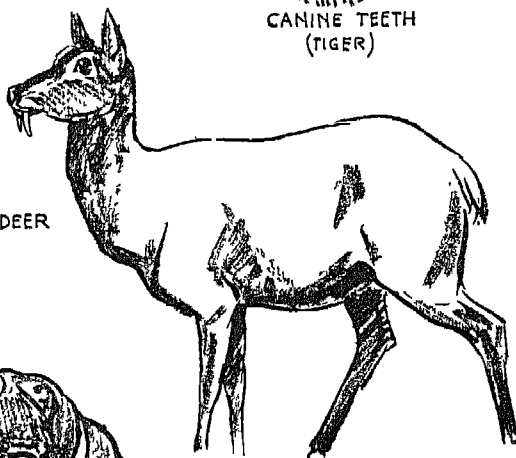
THE animal weapons most commonly feared by man are the teeth. It is instinctive for animals to defend themselves by biting if they have the right kind of teeth. Even human beings sometimes resort to using their teeth during a desperate hand-to-hand fight. The rodent's sharp chisel-like teeth are quite useful as weapons. Woodchucks, squirrels, rats, and mice all have such a reputation for biting that we dare not handle any one of them without gloves for protection, unless they are quite tame. The rodent's biting teeth are called the incisors, and they grow very fast. The rapid growth is necessary because these teeth get worn down from constant use. If it were not for this wearing down process, the teeth would grow to be fantastically long. They are kept sharp



INCISOR TEETH
(BEAVER)



CANINE TEETH
(TIGER)



ASIATIC DEER



WALRUS

at all times by the wearing process of the lower incisors against the upper ones. If an incisor tooth is broken off at the gum by accident, it will grow out in eight or ten days. The principal use of the incisors is not for fighting, however. They serve as cutting tools with which to bite off roots and gnaw the shells of nuts and seeds. Some rodents use these teeth for digging purposes. The beaver's incisors are exceptionally sharp and strong for use in cutting down trees.

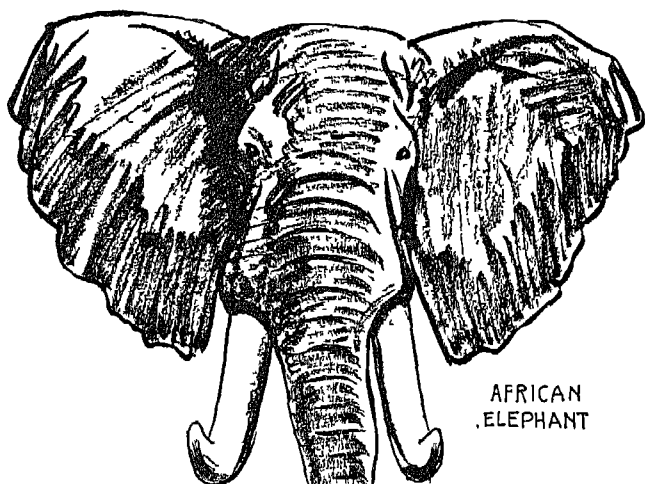
Carnivorous animals have a different type of teeth which are suitable for killing prey or fighting rivals. They are called the canine teeth and there are four of them. The two lower canines fit in front of the two upper ones when the jaw is closed. Being long and pointed in shape, these teeth can be used to puncture, slash, or hold. I have seen the carcass of a caribou killed by wolves that was so slashed and mutilated that it looked as if it had been cut by butcher knives.

It is rather unusual for herbivorous animals to have canine teeth, but there are several species of Asiatic deer of which the males have long sharp canine teeth that are used for fighting.

The growth of the canine teeth differs among the species of wild swine, where the two upper canines are diverted in an upward direction and project on

the outside of the animal's mouth. Such teeth are generally called tusks. The African wart hog grows an enormous pair of tusks that are useful for uprooting the ground as well as for weapons when fighting. The babirusa is a good example of an animal whose teeth are overdeveloped. This strange-looking animal's upper canine teeth grow through the skin on the top of the snout and curve backward so far that the points sometimes come in contact with the forehead. Such teeth as these are utterly useless either for procuring food or for fighting, but maybe the pigs find them decorative, if nothing else.

The largest tusks of present-day animals are grown by the African elephant. The walrus has a sizable pair of tusks and the narwhal has a single long, straight, spearlike tusk that grows to a length of eight or ten feet. The elephant and walrus tusks are used principally for digging and procuring food. They also serve as weapons when needed, but the narwhal's tusk is purely a fighting instrument. The elephant depends more on the crushing power of his huge feet when he is attacking animals smaller than himself, but he makes good use of his tusks when his adversary is another elephant.



AFRICAN
ELEPHANT



WART HOG



BABIRUSA



NARWHAL



THE TONGUE AS A WEAPON

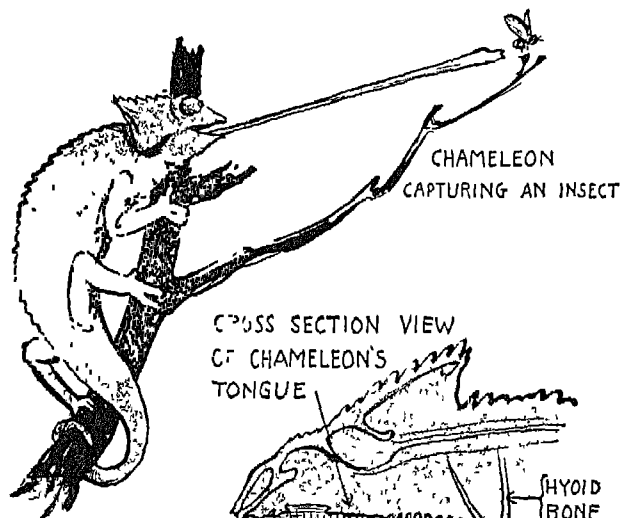
I AM sure that we all agree that the tongue of a nagging person can be a very offensive weapon. Some animals use their tongues for weapons, too, but in quite a different manner. They capture insects with them. Toads and frogs can project their tongues from their mouths to capture small insects which are their main source of food. There is a sticky substance on the tongue which holds the victim when contact is made. The tongues of most toads and frogs differ from those of the higher vertebrates in that they are attached to the inner side of the front of the lower jaw with the tip pointing down the throat. This unusual position of the tongue makes it possible to project it for quite some distance. When a toad or frog wishes to catch a fly that has settled within range, it literally spits its tongue out, and the fly adheres to the sticky mucus. The tongue flips back into the

mouth bringing the fly with it. This operation is done so rapidly that the human eye can scarcely see the action.

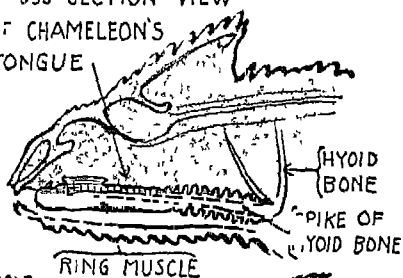
One of the most interesting of all tongue weapons was brought to my attention some time ago when I was asked by the editor of *Natural History Magazine* to illustrate a story about a chameleon written by Dr. Robert Cushman Murphy. The chameleon is indeed a strange reptile. He has the ability to change the color of his skin to match whatever object he is standing on, and he can operate his gun-turret eyes in two different directions at the same time. In addition to these accomplishments, he has one of the most remarkable tongues for catching insects in all the animal world. This versatile lizard can project his tongue as much as twelve inches beyond the tip of his nose with such lightning speed as to be almost invisible.

The anatomical features that make such a feat possible were all revealed to me by a careful dissection of a specimen preserved in alcohol. The secret of the great speed and distance attained by the chameleon's tongue lies in the very specialized anatomy of that organ. A series of muscles surrounds a sheath-like tube running through the interior of the tongue. A tapering bone (median hyoid) projects forward from the hyoid bone into the sheath. The sudden

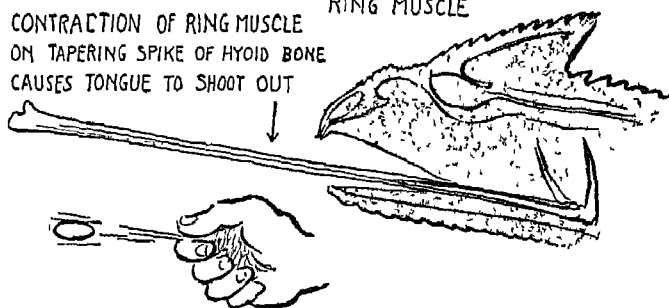
FROG CATCHING AN INSECT WITH ITS TONGUE



CROSS SECTION VIEW
OF CHAMELEON'S
TONGUE

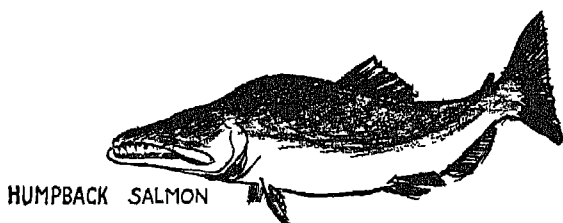


CONTRACTION OF RING MUSCLE
ON TAPERING SPIKE OF HYOID BONE
CAUSES TONGUE TO SHOOT OUT



contraction of the ring muscles on the slippery tapering bone sends the tongue forward as though shot from a catapult. The principle of this action is the same as that which causes a cake of wet soap to fly out of the hand when the fingers are contracted suddenly. Two very elastic muscles (hyohyoideus) run parallel to each other on either side of the tongue. These muscles retract the tongue after it has been expelled by the contraction of the ring muscles.

The tip of the tongue is covered with a sticky fluid to which the insect adheres.



ARMED FISH

FISH are almost wholly dependent upon animal life for their food supply. They are also quite cannibalistic, even to the extent of eating their own young.

In spite of the high death rate, nature has kept marine life well balanced by providing a very high rate of reproduction, particularly among the fishes. The roe of some of the large fish contains around nine million eggs, while the smaller fish roes might produce two million or more. A codfish roe contains from six to seven million eggs. Only a very small proportion of the fish hatched from this vast quantity of eggs ever reaches maturity, because other animals devour not only many of the eggs but great numbers of the newly hatched fish. Of those that do reach an adult size, the fisherman's nets take a heavy toll. From the six million eggs in a single codfish roe, it is doubtful if more than a dozen fish ever survive to live their full life span. On the other hand, if every

egg developed into a mature fish, the sea would soon become clogged with an overabundance of life.

Many fish have weapons that help to reduce the extremely high death rate caused among them by the predatory animals. Perhaps the best known fish weapons are those of the common catfish or horned pout, found in many of the rivers and ponds of the United States. The boys who fish for horned pout soon learn how to handle them so as to avoid being pricked by the spines in the pectoral and dorsal fins. These spines are the fighting weapons of the be-whiskered catfish. Many boys have howled with pain and sometimes suffered from blood poisoning as the result of being pricked by their spines, for there are glands at the base of them which secrete a toxic poison.

In some of the fresh-water streams of this country there is a tiny fish known as the stickleback. The males are very pugnacious and often fight with one another. The stickleback has a number of exceedingly sharp spines on his back and may use them as weapons for fighting.

The salt-water fishes have a variety of interesting weapons. The comical-looking blowfish or porcupine fish is very well armed, having sharp spines, poison, and extremely powerful cutting teeth. The spines are modifications of scales that have become so spe-

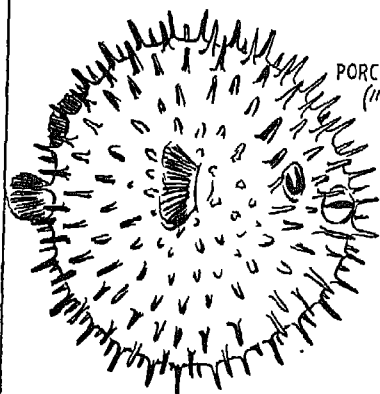
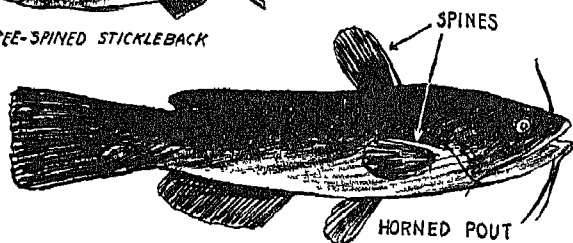
cialized as to look and act like spines. When the fish is alarmed, it inflates its body by inhaling air or swallowing water, causing all the spines to stand erect. When deflated and swimming about undisturbed, the spines lie back in a streamlined fashion close to the body. Adding to this prickly defense, some blowfish have the ability to emit a poison from the glands in their skin. The third part of the blowfish's defense consists of his powerful, sharp teeth which are strong enough to sever a man's finger in one bite. Not many animals care to swallow such a well-armed specimen as this little animated pin cushion, so the porcupine fish is seldom eaten by other fish.

The male Pacific salmon does not develop his fighting weapons until he is mature and ready to enter the fresh-water streams for the spawning season. What was once a rather handsome fish turns at that time into a hook-beaked, snaggle-toothed warrior, ready to fight off any fish that may approach the eggs that his mate has deposited in the nest on the stream bed. It may be that the male salmon's fighting face is developed for the defense of his nest during the brief time that he lingers near the eggs. A few weeks after caring for the eggs, this weary fighter dies, as do most of the salmon who go up the river to fulfill their life's purpose on the spawning grounds.

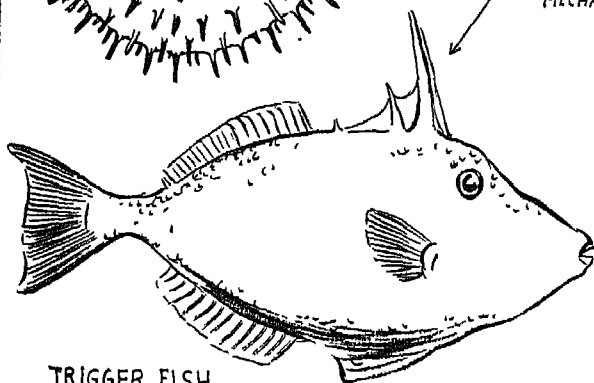
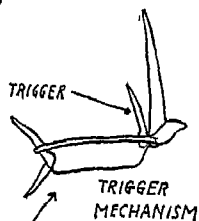
The surgeon fish has no medical skill, but he gets



THREE-SPINED STICKLEBACK



PORCUPINE FISH
(INFLATED)



TRIGGER FISH

such a name because he has scalpel-like spines on either side of his tail. These fish use their spines as weapons of attack by erecting them and striking sideways with their tails.

A friend told me that he had captured several trigger fish during an expedition to the South Seas. His story of the strange action of the trigger apparatus interested me, so I obtained a skeleton of the fish from the museum and tried to figure out how it operated. There is a long spine situated in the front part of the dorsal fin. When this spine is erected by the fish it becomes locked in position, and unless the trigger spine is touched no amount of pressure is able to push it back to its normal position. The trigger spine is located just behind the erected spine and is hinged to a hollow bone in such a way that its base acts as a key to lock the tall spine in position. The defensive value of the tall spine may be to serve as an obstruction to prevent some big fish from swallowing its owner. It is very difficult to understand why this weapon of quite limited defense value needs such a complicated apparatus to operate it, while some far more elaborate weapons are comparatively free of mechanical devices.

The swordfish, sailfish, marlin, and spearfish have long, swordlike appendages. Although these fish are capable of spearing other fish with their swords, they

are more inclined to strike their prey with a sideways motion of the sword, which stuns them. However, the sword may be used offensively as a spear when the fish is angry and attacking other animals. There are many apparently well-authenticated stories of swordfish attacking the bottoms of boats. If such stories are true, the power of a swordfish's thrust is amazing.

There is an exhibit in the Fish Hall at the American Museum of Natural History in New York showing a section of a dory with the broken-off sword of a fish transfixed in the wood. The tip penetrates to a distance of eighteen inches through the bottom planking which is one inch thick.

From England come even more fantastic revelations of the swordfish's strength. In the British Museum in London there is a section of a ship's side in which the fish's sword has penetrated to a depth of twenty-two inches into solid timber. Another English story mentions a swordfish's attack on the bottom of a whaling ship in which the sword was driven eight and a half inches into solid timber.

I would think that the speed necessary to drive their swords so deeply into a ship's timbers must have given those fish a terrible shock when they hit.

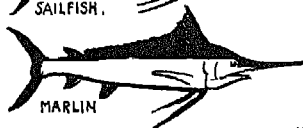
The sawfish has a particularly vicious weapon. This fish is found in tropical waters and may grow to



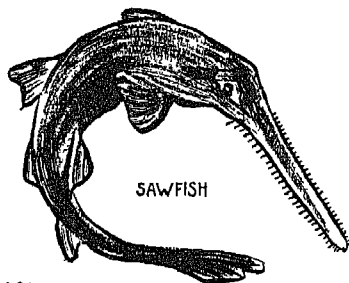
SWORDFISH



SAILFISH.



MARLIN



SAWFISH

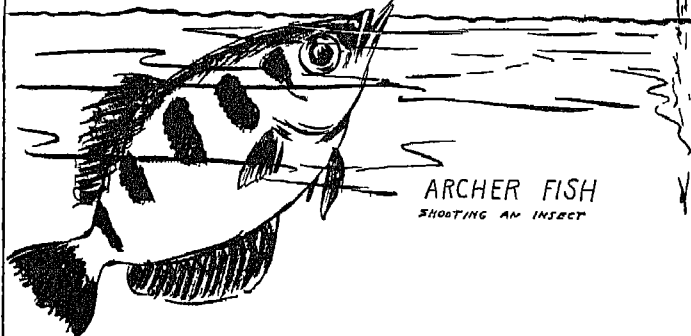


SURGEON FISH



GROOVE TUBE

ROOF OF ARCHER
FISH'S MOUTH
(AFTER DRAWING BY J. S. K. M.)



ARCHER FISH
SHOOTING AN INSECT

a length of twenty feet. The saws on the larger fish are nearly six feet long and one foot wide at the base. The sawfish weapon looks like a long sword with many sharp teeth sticking out on its lateral surfaces. To use the saw effectively, the fish strikes the victim with a sideways motion through the water. Indian records state that sawfish have been known to kill bathers by cutting them in two with a single blow.

I think the most interesting of all animal weapons is the archer fish's blowgun. As an introduction to the habits of this remarkable fish, let me repeat a little story that seems incredible although I have reason to believe it is true.

Some time ago a man was seated at breakfast on the veranda of his house in faraway Siam. It was a particularly pleasant place to enjoy an early morning meal, for the veranda extended to the very brink of a small pool in which there were many beautiful aquatic plants and a number of small fish. When he had finished eating, the man lit a cigarette and moved over to the railing to admire his tropical garden pool. Suddenly there was a sputtering noise as the man's cigarette went out, apparently extinguished by a drop of water. This would not have seemed unusual except that the drop of water came up from the pool, propelled by a force such as might come from a boy's water pistol.

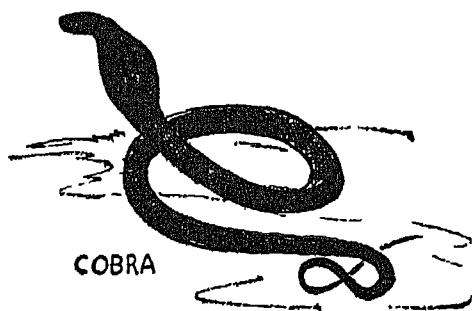
To most of us this incident would be a baffling mystery, but not so with the Siamese gentleman. He knew at once who the culprit was. The marksman was one of his pet archer fish.

This fish, which feeds on insects, does not employ a bow and arrow as the name, archer fish, may suggest, but it does shoot at its prey, using pellets of water for ammunition. The weapon that shoots the water pellets is somewhat like a blowgun and is situated in the roof of the fish's mouth.

The most surprising part of this fish's shooting ability is the accuracy of his shots, which can topple an insect five or six feet above the water. In order to make hits, it is necessary for the fish to come close to the surface, with the top of the mouth barely extending above the water.

A very specialized development of the mouth parts enables the fish to project drops of water with considerable force. There is a narrow slot less than one sixteenth of an inch in diameter running along the middle of the roof of the elongated mouth. If the tongue is pressed tightly to the roof of the mouth, the slot becomes converted to a tube. When the fish wishes to shoot, it forces water into this tube by compressing its gill covers. The tip of the tongue acts as a valve to regulate the pressure and release the water in the form of drops, or in jet fashion. By controlling

the pressure in this manner, the fish is able to shoot at various distances up to the limit of its range, which is about ten feet. The archer fish makes a very interesting pet, and furnishes lots of entertainment by shooting at insects suspended on a thread over the aquarium.

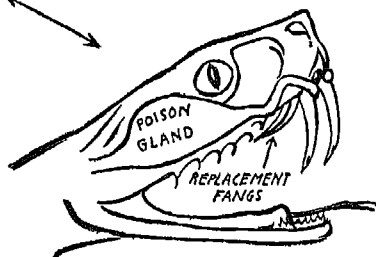
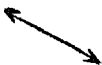
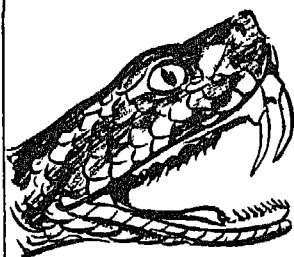


POISON

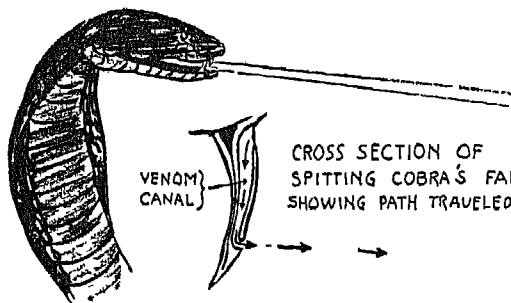
IT is probable that a poisonous snake is feared more by man than by the lower animals who do not realize that such a relatively small reptile carries one of the deadliest of all weapons. Human beings have the reasoning power to understand the danger of a poisonous snake bite, and most of them have to admit that they do not relish the idea of getting anywhere near a rattlesnake or copperhead. It seems to me that the imaginative mind of man is impressed by the lethal power of the silently working venom. Its invisible, speedy action horrifies him more than would a fatality caused by some action that can be seen, although the result is the same.

No doubt there are a few animals who have learned to fear snakes. I believe that most small birds feel a genuine terror of them and possibly the rabbits have learned to fear them. On the other hand,

THE RATTLESNAKE'S
DEADLY WEAPONS

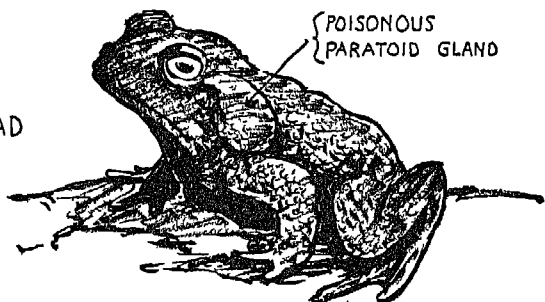


SPITTING COBRA



CROSS SECTION OF
SPITTING COBRA'S FANG
SHOWING PATH TRAVELED BY VENOM

TOAD



the actions of a large rat which had been put in a cage with a rattlesnake showed that it had no fear of it. The rat calmly walked all over the snake and even attempted to nibble its rattle.

Poisonous snakes are armed with a pair of long, hollow, needle-sharp fangs that are folded back into sheaths in the roof of the mouth. The snake has a very definite muscular control over the action of the fangs and can erect them instantly, either individually or together. The fangs are shed periodically, the new ones growing out while the old ones are still in use, so that they are ready for action as soon as the old fangs are dropped.

The effect of being bitten by a snake's fangs would be no more harmful than a pin prick if it were not for the venom. The fangs are merely hypodermic needles for piercing the flesh, while the venom does the killing. The venom is stored in two glands located on either side of the snake's head just below and back of the eyes. A duct leads from each gland to a fang. The action of certain muscles in the head forces the venom out through the hollow fangs when the snake strikes. Some snakes, particularly the African cobras, squirt venom into the eyes of their enemies, causing great pain and temporary blindness.

Venoms contain a number of harmful substances. One of these is called neurotoxin. This paralyzes the

nerves and is the most dangerous of all the elements found in venom. Other elements in venom destroy the blood cells, prevent the blood from clotting, and rupture blood and lymph vessels. The venom of the cobra contains a large percentage of neurotoxin which makes these snakes the fastest killers of all. It is fortunate for us that almost all of the poisonous snakes in this country have a very small proportion of this deadly neurotoxin in their venom, the coral snake which belongs to the cobra family being the exception.

It is indeed strange that nature has given these snakes such a powerful weapon when there are many harmless snakes that seem to survive just as well without hollow fangs and poisonous venom.

Who would think that the clumsy, homely toad has a defensive weapon charged with poison? The toad's poison glands are the two large wartlike areas on the sides of the neck behind the eyes. When the toad is excited, these glands secrete a milky liquid that seeps through the pores in the skin. The secretion has little or no effect on the skin of any animal, but it is extremely poisonous if it enters the circulatory or the digestive system. I have seen dogs made ill by picking up ordinary garden toads. The Arizona toad is so poisonous that a dog or fox may die if it gets some of this venomous secretion in its mouth.

A museum herpetologist told me a story about a toad and a turtle that illustrates the value of poisonous glands as a weapon for defense. He had set free a number of toads, and as he watched them swimming about on the surface of the pool a turtle suddenly appeared, grasped one of the toads in its jaws, and swam down out of sight. In a moment an oily substance was seen floating on the water. Then the toad popped up to the surface and swam off, apparently uninjured. The turtle did not come up to molest any more of the toads, for he had found the captured one very distasteful because of the poisonous secretions from the glands.



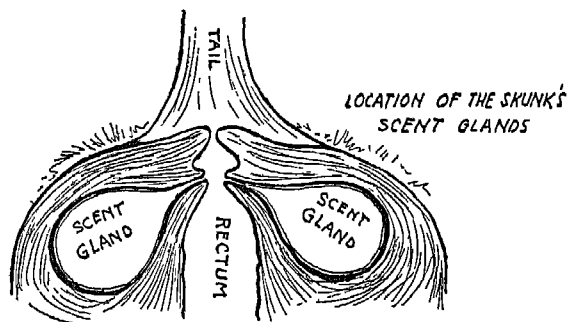
ODOR

ANY discussion of animal weapons is certain to bring mention of the skunk's well-known defensive artillery that uses an odorous fluid for ammunition. At close quarters the scent is very objectionable, but personally I enjoy a faint whiff of it on the cold night air. This may be because it always recalls the days when I trapped skunks and the teacher sent me home from school because the odor was still on my clothes.

The skunk's scent is extremely pungent and has great lasting strength. Any dampness in the air seems to revive the odor. I had a pair of woolen mittens that smelled of skunk for over a year.

The fluid that causes the odor is secreted by two glands located near the base of the skunk's tail. It is amber-colored and according to some observers it

THE SKUNK



ANIMALS HAVING SCENT GLANDS



has a luminous appearance when seen at night. It has an injurious effect on the mucous membranes of the nostrils and causes violent retching and vomiting if it gets into the mouth. The acid quality of the fluid causes excruciating pain and temporary blindness if it touches the eyes.

This brings to mind the recollection of having seen my collie dog innocently run up to a skunk. The poor dog received a blast from the skunk's battery that got into her eyes, nose, and mouth, causing agony that was pitiful to see; but she learned never to go near a skunk again, a tribute to the effectiveness of the skunk's smell-gun.

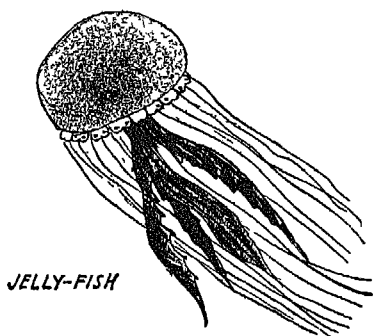
To discharge its scent, the skunk raises its tail and, by muscular contraction, forces the fluid from the glands through the two small nipplelike openings that protrude when the skunk is ready for action. The effective shooting range of a full-grown skunk is eight or ten feet, but the odor may be carried by the wind for a mile or more. A fully loaded scent gland might contain enough fluid for five or six shots. Should these glands be emptied, it would require a week's time to refill them.

I was told once that a skunk cannot discharge its scent if held off the ground by its tail. I was somewhat skeptical about the truth of this statement until I saw the act performed successfully by a friend.

However, I would not advise anyone to try this stunt, for it might "backfire."

Skunks can be tamed so that they may be handled without fear of getting their scent-guns into action, but any sudden fright is liable to cause trouble.

The skunk is not the only animal that uses odor as a weapon. Snakes, foxes, wolverines, mink, weasels, and several other animals have scent glands of more or less similar nature, but for effectiveness the skunk's weapon remains supreme.



SHOCKS AND STINGS

THE ability of certain fishes to generate electric current has always been of great interest to man. Electricity can be produced easily by mechanical means, but the electric eel and the electric ray make it by an organic process in their own bodies. That is a feat that man has been unable to perform.

The electric current produced by these fish acts in the same manner as the current created by a battery. It can emit sparks, light an electric bulb, and act on chemical compounds.

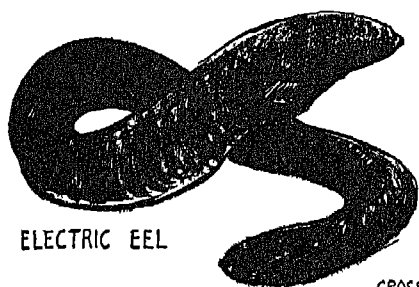
The electric eel can give a terrific shock with its two pairs of current-producing organs. One pair lies beneath the swim muscles on the back of the tail, the other pair along the sides of the base of the anal fin. These structures can produce as much as two

thousand watts of electricity, which is equal to the power of a two-hundred-and-forty-cell battery.

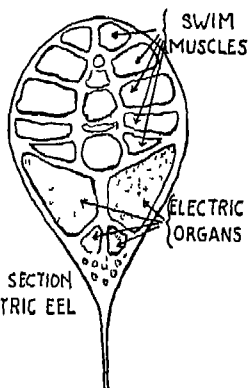
The location and structure of the electric ray's shock-producing organs is quite different from that of the eel. The ray's battery consists of a number of cells that run perpendicularly through the body on either side near the head. The upper side of the ray is the positive and the lower side is the negative. If the ray is out of the water, it is necessary to touch both positive and negative sides of the fish in order to complete the circuit and produce a shock. However, when in the water only one point of contact is necessary for the water acts as a conductor to complete the circuit.

Both the eel and the ray use their electric power to stun the animals upon which they feed, but if they are molested the shock is used as a weapon for defense, and a very effective weapon it is.

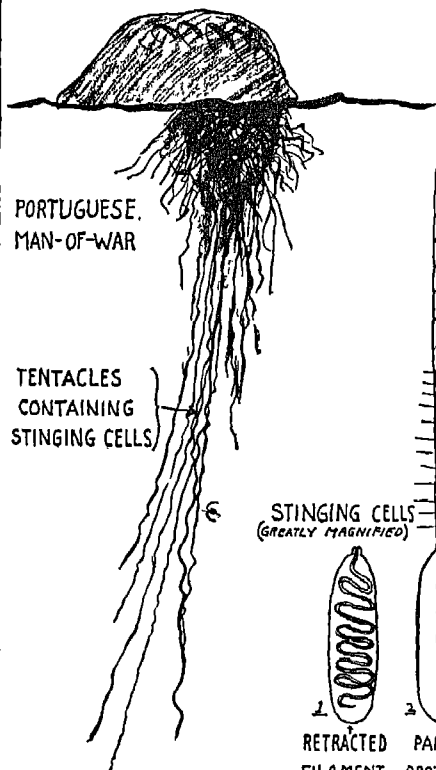
What seems to me the most diabolical of all animal weapons are the stinging capsules of the jelly-fish and their relations. These harmless-looking aquatic animals have a fragile beauty that is very deceiving. Their stinging powers surpass that of any insect, spider, or scorpion, for nowhere can we find such a fiendish array of weapons as these microscopic stinging cells. The most beautiful and dangerous of these animals is the Portuguese man-of-war.



ELECTRIC EEL



CROSS SECTION
OF ELECTRIC EEL



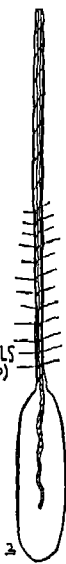
PORTUGUESE,
MAN-OF-WAR

TENTACLES
CONTAINING
STINGING CELLS

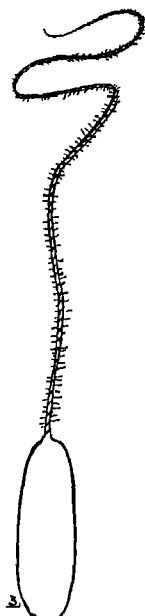
STINGING CELLS
(GREATLY MAGNIFIED)



1
RETRACTED
FILAMENT



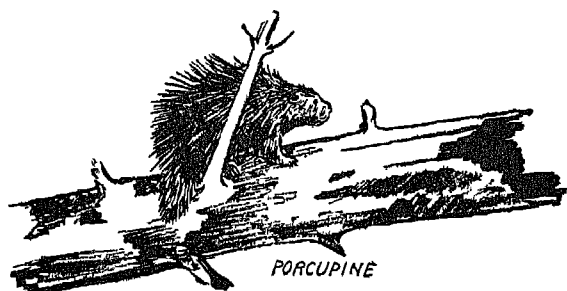
2
PARTLY
PROTRUDED



3
FULLY
PROTRUDED

It sails about on the surface of the sea by means of an inflated bag which keeps the colony afloat. I say "colony" because the Portuguese man-of-war is not a single animal but a number of individuals, each of which has its own special function. Gas is expelled from the float organism when the colony wishes to submerge. Attached to the underside of the float organism are numerous threadlike tentacles, some of which may be fifty feet long. The tentacles are armed with many microscopic sting cells. Even though they are small in size, these cells possess stinging powers which cause the severest pain and even death to any animal that comes in contact with them.

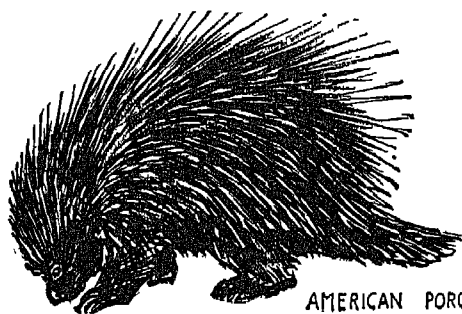
The mechanism of a stinging cell is quite complex, but it may best be described as an inverted tube coiled up in an oval-shaped cell, and covered by a lid on which is a trigger hair. The slightest contact with the trigger hair causes the lid to fly open and the walls of the cell to contract, ejecting the tube. As it is ejected, the tube turns inside out, exposing hundreds of sharp spines on its surface. The tube is filled with a poisonous substance which is released when it is inverted. After a cell discharges its tube of poisonous spines, it must grow a new one. The expelled tube cannot be withdrawn into its cell.



QUILLS

PORCUPINES are covered with quills on their backs and sides. This spiny armor gives them a good defense against possible attacks by predatory animals. The quills are hollow hairs growing out of the skin in the same manner as any kind of hair. They are loosely attached to the skin, so that when their sharp, barbed points stick into something the quills are pulled out of the porcupine. They cannot be shot out as some people believe. New quills grow in to replace those that pull out.

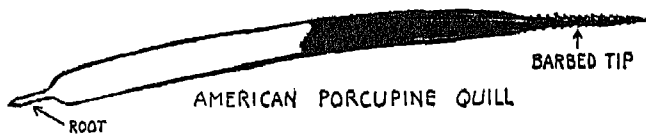
Not many people know that a tame porcupine can be handled and stroked like any pet. Only when he is angry is it dangerous to touch the quills. Then they are stiffened into a more or less erect position by the same kind of nervous reaction that makes the hair stand up on a frightened cat or dog.



AMERICAN PORCUPINE



AFRICAN PORCUPINE



AMERICAN PORCUPINE QUILL



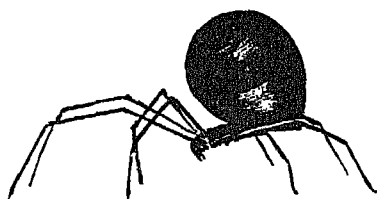
AFRICAN PORCUPINE QUILL

The pointed end of each quill is covered with a multitude of tiny barbs that curve away from the point like the barb on a harpoon. When a quill is embedded in the flesh it works its way in deeper and deeper. The barbs prevent it from working out in a reverse direction and also make it difficult and painful to pull out.

The longest quills on the North American porcupine are seldom more than three inches long and about a sixteenth of an inch in diameter. The biggest quills are grown by the African porcupine, some of them being eight to ten inches long and as thick as a lead pencil. I have just examined under a microscope the points of one or two of these big quills and am unable to discover any barbs such as I find on those of the North American variety.

The porcupine can use his quill-covered tail as an offensive weapon. It is very unwise to climb a tree in which a porcupine is located for he may start to back down toward you, lashing his stout tail from side to side. If the tail hits you, it will drive a number of quills deep into your flesh.

Although he is well armed, the porcupine is not bad-tempered or aggressive. He prefers to mind his own business and I imagine that he expects others to do the same.



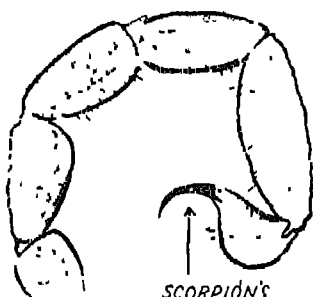
BLACK WIDOW SPIDER

THE WEAPONS OF INSECTS AND THEIR RELATIVES

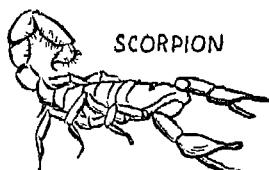
IF YOU are looking for thrills and adventure in the field of natural history, do not overlook little animals like insects and spiders. Most people disregard them or think of them only as nuisances. Some insects are pests, but they are also important to the working plan of nature. Insects are very useful in pollinating the flowering plants, and many birds and other animals depend on them for food.

Aside from their useful purposes, insects and spiders are the most interesting of all animal subjects for the nature student to study. The life history of many of these little creatures is so amazing and fascinating that the naturalist often becomes completely absorbed by the subject.

In my search for animal weapons I learned that insects and spiders are quite well armed. Here we



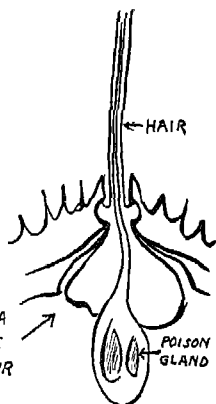
SCORPION'S
STINGER



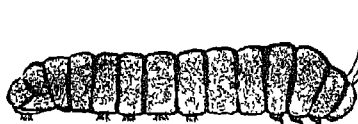
SCORPION



BROWN-TAIL
MOTH LARVA

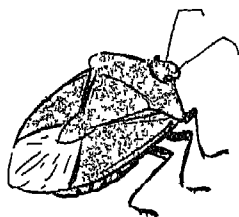


ANATOMY OF A
CATERPILLAR'S
POISONOUS HAIR

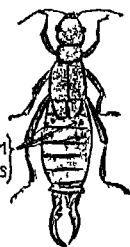


SWALLOWTAIL BUTTERFLY LARVA

OSMETERIA EXPANDED
TO DIFFUSE ODOR



STINK BUG



EARWIG

OPENINGS FROM
STINK GLANDS

find many adaptations in miniature of the same weapons used by larger animals. Poisonous bites and stings, obnoxious odors, horns, spines, and many new and curious weapons are all found among the diminutive warriors of the insect world.

I remember getting a severe itching rash from handling a small brown caterpillar. I never understood how this fuzzy little animal was able to inflict such misery, but now I know that I was a victim of the poisonous hairs on the caterpillar of the brown-tail moth. The hairs are the caterpillar's defensive weapons. They are hollow, and a poisonous substance, secreted by a gland, passes through them onto anything they touch. This type of defense probably prevents most birds from eating these caterpillars, for the poisonous secretion from the hairs must be very distasteful.

We have a lot of respect for the stinging weapons of bees, wasps, and scorpions. Their stings are all poisonous enough to cause considerable pain and sometimes severe illness. Because of their poisonous secretions, tiny insects can be as dangerous a foe as some of the large four-footed animals armed with teeth and claws. The scorpion uses its two pincers to grasp a victim; then it quickly curves its long tail around and drives the poisonous stinger into the soft part of the victim's body. The poison paralyzes

a small animal, but its effect on a human being is painful but not fatal.

There are some insects that use odor as a weapon just as skunks do. Some of the insects using this type of defense are the stinkbug, bedbug, lacewing fly, cockroach, and earwig. The disagreeable odor comes from a fluid secreted by special glands and excreted through a pair of openings on the insect's body.

The caterpillar of the swallowtailed butterfly has a very special organ (osmeterium) for diffusing a disagreeable odor. It is located in the top side of the first segment of the caterpillar's body and looks like a little pair of horns. Normally the osmeterium is withdrawn into its sheathlike gland, but when the caterpillar is disturbed the fork-shaped horns protrude and expose the smelly glandular secretion to the air.

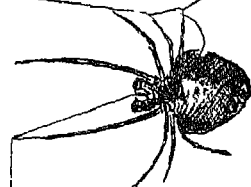
Have you ever put your hand on an ant hill? If you have, you know that ants can bite. They are brave little warriors who will fight any animal that invades their home territory. The fighting ant uses his mandibles for weapons, and his jaws, which work from side to side in pincer fashion, have astonishing strength.

There is a great deal of variation in the size and shape of the mandibles of the different species of ants. The common type of ant that we see running over the blades of grass on the lawn have rather



AFTER DRAWING
BY ALICE GRAY

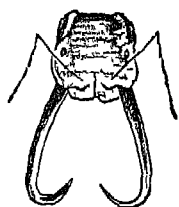
THE BOLAS
SPIDER POSED
FOR CATCHING
INSECTS



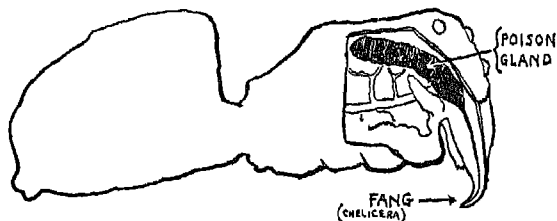
STICKY BALL →



HEAD OF COMMON TYPE ANT



HEAD OF ARMY ANT



ANATOMY OF THE SPIDER'S POISONOUS FANGS.

short, stubby mandibles, which are not very effective except when they bite insects of their own size. The soldiers in a colony of army ants have the most vicious mandibles of any ants. Army ants are feared by all living animals throughout the country which they inhabit. Their long columns march through the forest in search of food. Every animal who cannot run to escape, is attacked, from the smallest insect to animals as big as an elephant. Size makes no difference to these carnivorous ants.

Ants appear to be very intelligent. When a colony of Amazon ants go out on a raiding party, they act like well-disciplined soldiers. They use scouts to convey information. Their columns surround the enemy, block exits, and carry on their raid in a manner worthy of an army man's admiration.

Some ants even resort to gas warfare, using the fumes of formic acid to drive out the enemy.

The mathematical precision of the spiders' workmanship is revealed in the geometric designs of their webs. They do not have to spend four years in college to learn how to build them, for they are born engineers. It would save a lot of time and money if we could be born with an education as some animals are.

Spiders have a pair of ugly-looking hollow fangs that inject a poisonous substance when they bite.

The female black widow spider has a very powerful poison that causes extreme pain and illness to anyone bitten by her.

The spider web is usually made to act as a trap, but there is a very common species of spider (*mastophora*) that spins a line, weights it with a sticky ball of silk and throws it at its prey like a bolas. The bolas spider comes out at dusk to select a suitable location on a branch for her evening's hunting. She attaches a thread of silk to the underside of the branch, then proceeds along the branch for a few inches, and fastens the line to another spot. This makes a loosely hung line which will act as her trapeze. Going to the center of the trapeze, she attaches another thread to the line and draws out about two inches of silk. Before separating this line from her spinnerets, she uses her hind legs to comb out a mass of gluelike silk to form a sticky ball about a sixteenth of an inch in diameter. When this globule is of suitable size, it is separated from the spinnerets and allowed to swing free on the end of the line, like a pendulum weight. The spider moves back along her trapeze until she can reach down and grasp the swinging line, which she then adjusts between her mouth parts and one front leg.

Everything is now ready for the approach of some nocturnal insect. When one comes close enough, the

spider quickly swings her line toward the intended victim. The sticky ball strikes a wing and holds fast. The fluttering insect is soon stilled by a bite of the spider's poisonous fangs. The hunt is over.

MAN'S WEAPONS

WITH but a few exceptions, man seems to be the only animal who makes his own weapons. The first implement must have been a club or stone. Then, as his reasoning powers developed, man's weapons became more specialized. Sharp stones were turned into knives, spearheads, and arrowheads. No doubt there are still a few tribes of men in remote parts of the world who depend on such crude implements for fighting.

Later on, the longbow, spear, sword, and catapult were used until the Chinese invented gunpowder, the explosive power of which was soon applied to a series of weapons such as guns, cannons, and pistols. As man invented explosives having more force than gunpowder, he utilized this power in making bombs, torpedoes, and rockets.

The aerial bomb has developed in power until today we have the atom bomb which may lead to

the destruction of civilization and every living thing on the face of the earth.

Such is the beginning and possibly the end of the evolution of man-made weapons. It begins to look as though nature may have made a regrettable error when she endowed man with the faculty for invention.

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